7.1- Randomness

Random =

* Individual outcomes are uncertain
* Pattern/regular distribution in long run (lots of trials)

Ex: Coin flip, Roll 1 die, etc. , Plinko, Let's make a Deal

Probability =

* describes how often the event occurs decimal / %
* between 0 and 1 (or 0 and 100%)

Simulation =

* Using random digits (from a table, calculator, or computer) to imitate chance behavior

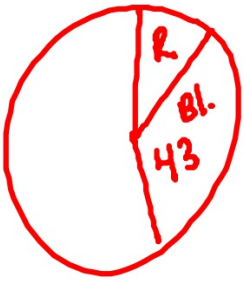
0-4 = right
5-9 = left

randInt(0,1)
(0,9)

* Let #'s = events
* Generate #'s to represent events happening (perform an expt)

00-99

randInt(1,6)



randInt(1,4)
(1,12)

Writing Instructions for a simulation:

1- Identify all outcomes & their probabilities

2- State your random number generator
(TRD or calculator)

3- Assign digits to represent all the outcomes.

4- State when you will stop one trial, and how many total trials you will perform

5- State your response variable

Example: A baseball player gets a hit in 30% of his at-bats. Simulate him coming to bat 12 times.

1) Identify the outcomes and their probabilities

Hit = 30%

Not Hit = 70%.

2) Decide on your generator and assign the events to the generator

TRD Hit = 00-29 = 0-2 = 1-3

Not = 30-99 = 3-9 = 4-0

3) What is your response variable? Create a table to record

hits

Hit	Miss
1111	𝍸 1111

line 132

4) What is one trial? How many trials?

one at-bat

12 trials total

$P(\text{hits}) = \frac{4}{13}$

$= 0.308$

30.8%.

Example: Picking a card, and looking at the suit. Simulate 10 picks.

1) Identify the outcomes and their probabilities

Heart = 25% Spade = 25%

Diamond = 25% Club = 25%

2) Decide on your generator and assign the events to the generator

TRD H = 00-24 S = 50-74 H = 1

D = 25-49 C = 75-99 D = 2

S = 3

C = 4

Ignore 5-9, 0

3) What is your response variable? Create a table to record

Suit of card

H	1
D	1
S	1111
C	1111

4) What is one trial? How many trials?

one card pick

10 trials total

Line 110

Example: A certain Stat class consists of 46% males. Simulate the teacher picking 8 students and recording their gender.

1) Identify the outcomes and their probabilities

Male 46%
Female 54%

2) Decide on your generator and assign the events to the generator

TRD M = 00-45 = 54-99
F = 46-99 = 00-53

3) What is your response variable? Create a table to record

4) What is one trial? How many trials?

Example: A spinner has 4 sections: 50% Red, 13% Blue, 12% Green, 25% Yellow. Simulate spinning the spinner 20 times.

1) Identify the outcomes and their probabilities

2) Decide on your generator and assign the events

Red = 00-49 .
Blue = 50-62
Green = 63-74
Yellow = 75-99 .

Example: Back to the baseball player who gets a hit 30% of the time. Assume he gets on average 3 at-bats per game. Simulate 15 games, recording the number of hits per game.

1) Identify the outcomes and their probabilities

Hit = 30%.

Miss = 70%.

line 120

2) Decide on your generator and assign the events to the generator

TRD Hit = 0-2

Miss = 3-9

P(H=3) = 0%

P(H=1) = 2/8 =

3) What is your response variable? Create a table to record

hits per game

# hits	frequency (#)
0	IIII
1	II
2	II
3	

$\bar{x}$ =

4) What is one trial? How many trials?

3 at-bats 15

Example: Back to the stat class... it consists of 46% males. A teacher needs to pick a group of 4 students. What is the chance that she gets all 3 males? Simulate this 5 times to make your decision

1) Identify the outcomes and their probabilities

Male = 46%

Female = 54%

2) Decide on your generator and assign the events to the generator

TRD M = 00-45

F = 46-99

line

125

3) What is your response variable? Create a table to record

$P(X=3) = \frac{2}{5}$

males in group

# M	Frequency
0	
1	I
2	II
3	II
4	

$\bar{X} = \frac{11}{5}$

$\bar{X} = 2.2$

4) What is one trial? How many trials?

4 students

5 times

Use the table to complete the simulation

04592 32952 29485 23947 59602 18375 10395 10934 59606

13487 23498 13284 23487 34857 21089 82973 42938 47589

27459 84275 87647 62097 45872 48755 61324 90480 19438

70648 75139 81457

# males	frequency
0	
1	1
2	
3	1
4	

Example: Picking a card, looking at the suit. We want to pick cards ***until*** we get a HEART. On average, how many cards will we need to pick? Do 5 trials.

1) Identify the outcomes and their probabilities

Heart = 25%. Heart 25%. Spade 25%.

Other = 75%. Diamond 25%. Club 25%.

2) Decide on your generator and assign the events to the generator

TRD Heart = 00-24 = 0, 1 Ignore 8, 9

Other = 25-99 = 2-7

3) What is your response variable? Create a table to record

cards until heart

# cards	
1	
2	
3	
4	
5	
6	
7+	

4) What is one trial? How many trials?

5 trials total

until get a heart

Conduct the simulation H=00-24

10984 37576 41509 87140 98755 09671 92843 76098

27435 09871 23875 09821 36458 20974 35098 21643

98750 43275 98236 49726 59810 98473 19863 47563

20497 25098 65276 81943 65726 43584 23460 27069

81734 50961 09745 89174 39865 32498 67298 34657

18643 75980 96424 08864 08862 $\bar{X}$ =

# cards	freq
1	|
2	|
3	|
4	||||
5	

#cards	freq
6	
7	
8	
9	
10+	| (25)

Try the Simulations Worksheet

#1)Instructions:

* Outcomes: Male = 50% Female = 50%

* TRD Female = 0 -- 4 Male = 5 -- 9

* 1 trial = having 3 children
  total 10 trials

* Response Variable = # of girls

39634	62349	74088	65564	16379	19713	39153	69459
17986	24537	92740	92438	03957	14595	35050	40469
27478	44526	67331	93365	54526	22356	93208	02847
91374	15374						

# G	freq	Exp. prob.
0	1	10%
1	𝍸	50%
2	111	30%
3	1	10%

10

#2) Instructions:

- outcomes: Girl = 50%
  Boy = 50%
- TRD Girl = 0-4
  Boy = 5-9
- one trial = until get a boy
  Perform 10 trials
- Response Variable = # of children they have

39634	62349	74088	65564	16379	19713	39153	69459
17986	24537	14595	35050	40469	27478	44526	67331
93365	54526	22356	93208	30734	71571	83722	79712
25775	65178	07763	82928	31131	30196	64628	89126

2 1 3 4 1 3 1 1 1 1 3 2

Girls = 0-4
Boy = 5-9

(3) · outcomes = complete = 65%
incomplete = 35%

· TRD complete = 00-64
incomplete = 65-99

· one trial = 12 passes
perform 6 trials

· Response variable = # complete

80583 70361 41047 26792 78466 03395 17635 09697

82447 31405 00209 90404 99457 72570 42194 49043

24330 14939 09865 46906 30734 71571 83722 79712

25775 65178 07763 82928 31131 30196 92347 60830

09230 47592 01832 05068 12838 12305 58506 37593

62941 17068

$\bar{X} = \frac{48}{6} = 8$

# comp.	freq
7	111
8	1
9	1
10	1
11	

4) Instructions:

* outcomes: catch = 78% miss = 22%

* Use TRD catch = 00 -- 77 miss = 78 -- 99

* One trial = 9 passes thrown to him
  Perform 10 trials

* Response variable = # catches

05409 20830 01911 60767 55248 79253 12317 84120

77772 50103 95836 22530 91785 80210 34361 52228

33869 94332 83868 61672 64628 89126 91254 24090

25752 03091 39411 73146 06089 15630 42831 95113

43511 42082 15140 34733 68076 18292 69486 80468

80583 70361 41047 26792 78466 03395 17635 09697

82447 31405

$\bar{x} = \frac{38}{6} = 6.33$ catches

#5)

outcomes: 6 different toys

all 1/6

TRD each toy # 1–6
ignore 7,8,9,0

one trial = until we get one of each of 6 toys

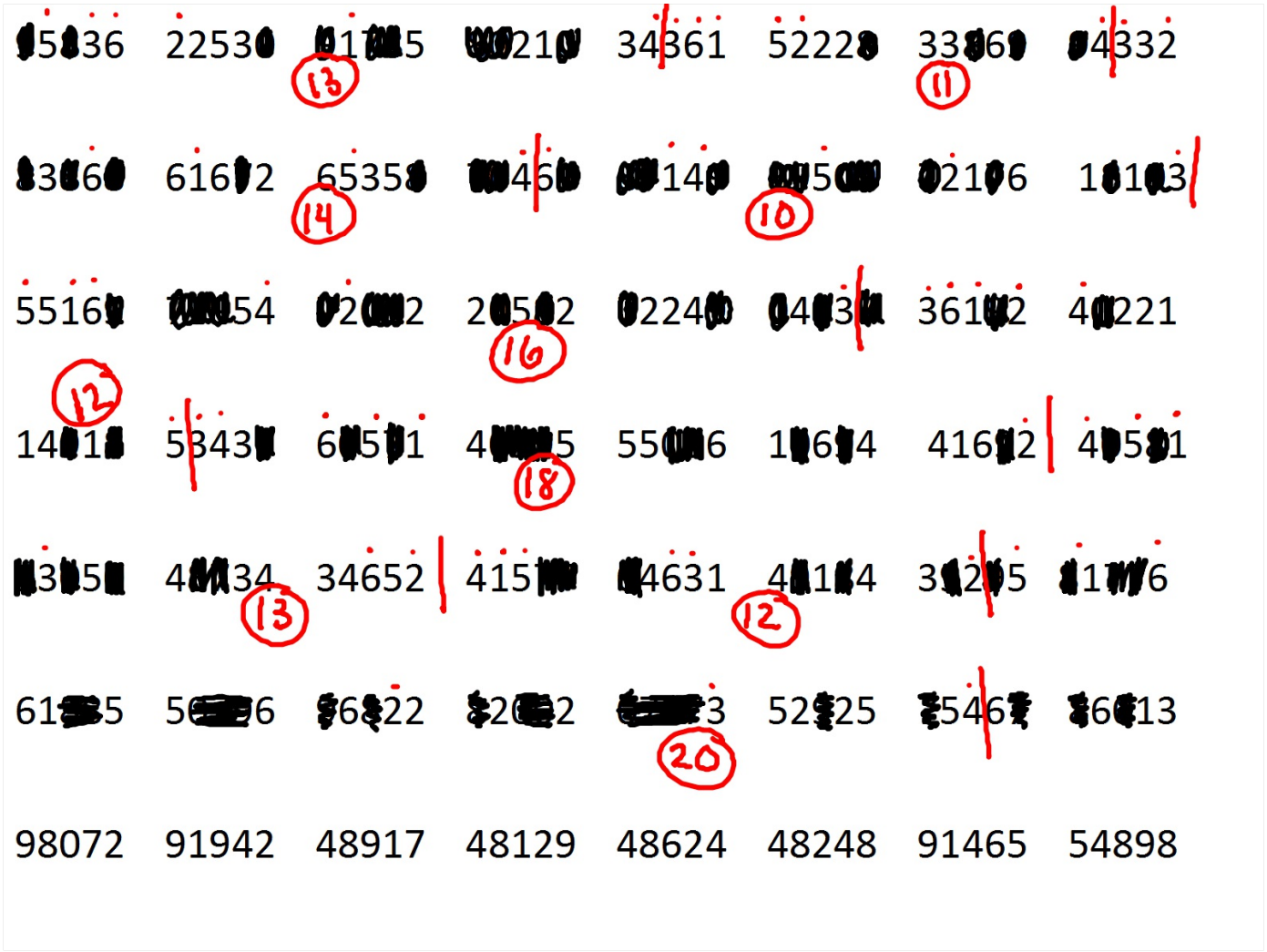
Perform 10 trials

Response Var = # boxes opened

95836 22530 91785 80210 34361 52228 33869

94332 83868 61672 65358 70469 87149 89509

72176


22530
34361
52228
98072
91942
48917
48129
48624
48248
91465
54898